

Oct 15-8:58 AM

4.4b Modeling and Optimization
Designing a can
beant juice
You have been asked to design a ~~one-liter~~ can shaped like a right-circular cylinder. What dimensions will use the least material?

minimize surface area

variables:
 h = height
 r = radius
 S = surface area

constant:
 V = volume = 1000
 $V = \pi r^2 h$

$S = 2\pi r^2 + h\pi 2r$

$S' = 4\pi r - \frac{2000}{r^2} = 0$

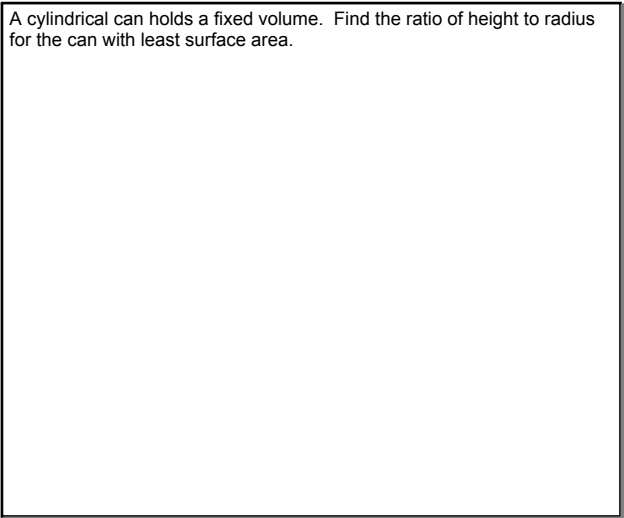
$r = 5.4193$

$h = \frac{1000}{\pi (5.4193)^2} = 10.838$

$S'' = 4\pi + \frac{4000}{r^3} > 0$

$h = 2r = d$

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A cylinder is inscribed in a cone of height 10 and radius 5. Find the volume of the largest ~~cone~~ cylinder

h = height of cyl.
 r = radius of cyl.
 V = volume
maximize $0 < r < 5$

$V = \pi r^2 h$

$\frac{10-h}{10} = \frac{r}{5}$

$r = \frac{10-h}{2}$

$V = \pi \left(\frac{10-h}{2}\right)^2 h$

$V' = \pi \frac{(h-10)(3h-10)}{4}$

$h = 10$ $h = \frac{10}{3}$

$V\left(\frac{10}{3}\right) = 116.355$

$V'' = \pi \frac{(3h-20)}{2} \Big|_{h=\frac{10}{3}} = -5\pi$

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